Tatemi SHIMIZU*:

A taxonomic and cytological note on *Adenophora* of Taiwan

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The genus *Adenophora*, as Baranov[1)] puts it, possesses with the distinct tendency to polymorphism, which makes it an unexhaustable source of the material for taxonomic exploration. Owing to this fact, I am much interested in the classification of the genus, and the cytotaxonomic study on the plants of Japan and Taiwan is now in progress in our laboratory. The present paper includes the result of the chromosome counts of two species from Taiwan and a taxonomic treatment on the whole *Adenophora* of Taiwan.

I am very much obliged to Dr. M. Tamura and Mr. H. Koyama for their gift of some living samples of the Taiwan *Adenophora*. Thanks are also due to the curators of the herbaria of the University of Kyoto, Kyoto (KYO), the National Taiwan University, Taipei (TAI), the Taiwan Forestry Research Institute, Taipei (TAIF), the University of Tokyo, Tokyo (TI) and the National Science Museum of Tokyo, Tokyo (TNS) for their permission to the examination of the specimens preserved therein.

Chromosome count

Some living samples of *A. triphylla* and *A. uehatae* came to me in the fall of 1964 from the subalpine region of Mt. Nengkao-shan and the alpine region of Mt. Chungyangchien-shan respectively, both in the northern part of the Central Mountains of the island. After a cultivation in the greenhouse for more than three months, root-tip cells of each plant were used for chromosome count by means of squash method. The result was that all the material were counted as $2n=34$ (fig. 1; A, B). As shown in the figure, size and shape of chromosomes are not so variable in both the species. The difference of karyotypes between them is not yet distinctly detected. Sugiura[2)] reported that there were found $n=17$ (diploid) in some species and $n=51$ (hexaploid) in others of the present genus. Both the species of Taiwan, *A. triphylla* and *A. uehatae*, belong to the diploid plants. In addition, *A. petrophila* from Mt. Myogi in middle Honshu seems to be tetraploid, $2n=68$ (unpublished).

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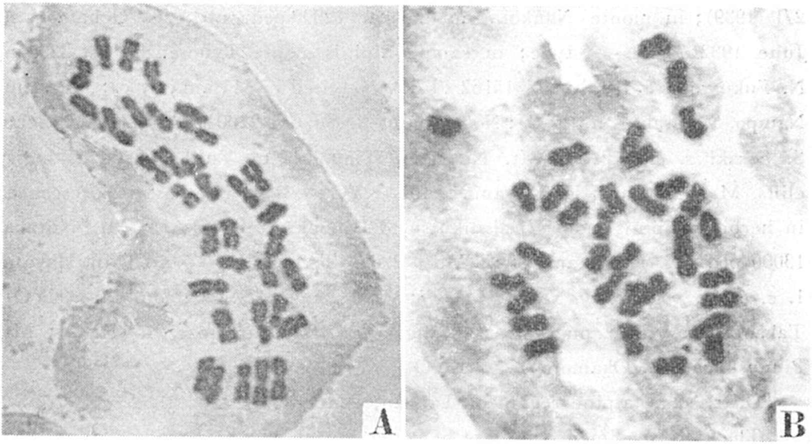

Fig. 1. Root-tip mitosis in the Taiwan *Adenophora*, showing 2n=34 chromosomes.
A. *A. uehatae* from Mt. Chungyangchien-shan
B. *A. triphylla* from Mt. Nengkao-shan

Taxonomic treatment

1. Leaves alternate; corolla 1.5～3 cm long, campanulate; style not exserted; disc discoid, ca. 1 mm high.
    2. Flowers usually solitary or a few; stems hispid with retrorse unicellular hairs .... *A. uehatae.*
    2. Flowers usually many in inflorescence rarely solitary; stems glabrous .... *A. morrisonensis.*
1. Leaves 3～4 verticillate; stems more or less pubescent; corolla 0.5～1 cm long, tube-shaped; style exserted; disc cylinder-like 2～5 mm tall .... *A. triphylla.*

1) **Adenophora uehatae** Yamam. in Journ. Trop. Agr. Soc. **4**:484 (1932) ——*A. coelestis* Diels var. *uehatae* (Yamam.) Masam. in Trans. Nat. Hist. Soc. Formos. **29**:271 (1939), ut *coelurai*——'*A. polymorpha* Fisch. var. *lamarckii* Trautv.'; Hayata, Fl. Mont. Formos. 148 (1908); Masam., Short Fl. Formos. 211 (1936).

Specim. exam. Mt. Tsugitaka, K. Mori s. n. (TAI); the top of Mt. Hsuehshan to Mt. Huanshantashan 3300-3900 m, H. Koyama 24035 (KYO); Mt. Tapachienshan to Mt. Hsuehshan, K. Kojima s. n. (TNS); Bunakke. in Mt. Nankotaizan, T. Suzuki et al. 18058 (TAI)——cited in Masam., l. c.

271 (1939); in monte Nankotaizan, ad ca. 12000 ped. alt., T. Uehata s. n. June 1932 (TAI) —— type; in campis alpinis monte Tyuosenzan ca. 3200 m, N. Fukuyama & T. Suzuki 15162 (TAI) —— cited in Masam., l. c.; Kiraishu-Nampo, S. Sasaki s. n. (TAI); Noko-ambu, S. Suzuki 2200 (TAI); Higashinoko, S. Sasaki s. n. (TAI); Mt. Nengkao, Tienchih to Yunhai 2700 m, mossy cliffs, M. Tamura & H. Koyama 23401 (KYO) —— with ramose inflorescence; in herbidis alpinis montis Daisuikutsu, T. Suzuki 18485 (TAI); Mt. Niitaka, 13000 ped., T. Kawakami & U. Mori 2266 (TAIF, TI) —— cited in Hayata, l. c. as *A. polymorpha* var. *lamarckii*; Mt. Kwanzan, S. Okamoto s. n. (KYO); Takao-Taito border on the Kwanzangoe-pass, S. Okamoto s. n. (KYO); Mt. Pinanshuzan, S. Okamoto s. n. (KYO).

Distr. The alpine region of Taiwan, endemic.

The type specimen, the date of collection of which is read as 'June 1932' in spite of the original publication 'July 19, 1932', is represented by two plants, one with two flowers and the other with one. Yamamoto accounted *A. tashiroi* Makino et Nakai is the most affined to the present species. But these are easily distinguished from each other by the form of the disc; the disc of *A. tashiroi* is cylindrical and that of *A. uehatae* discoid. From this view-point, the latter is rather related to the Japanese counterpart, *A. nipponica* Kitam., formerly referred to *A. polymorpha* var. *lamarckii.* One of the specimens cited by Hayata (1908) as *A. p.* var. *lamarckii* is distinguished from *A. nipponica* by having dentate slender calyx lobes and densely hirsute stems. Hara[3] discussed the characters of *A. nikoensis*-group and arrived at the conclusion that *A. nikoensis* and *A. nipponica* would be the same, the latter being reduced to *forma* of the former. The plants referable to *A. nikoensis* f. *nikoensis*, according to him, have narrow and dentate calyx lobes 4~9 mm long. The type specimen of *A. uehatae* is provided with dentate calyx lobes 6~10 mm long. However, the question if *A. nikoensis* and *A. uehatae* are the same would be resolved by the fact that the former had nearly glabrous stems and usually ramose inflorescences, while the latter have stems usually simple and conspicuously hispid with retrorse unicellular hairs. The leaves vary from ovate to linear in shape, being not over than 6 cm long and 3~15 mm broad. It is noticeable in particular that this plant grows on wind-screened and rubbly grounds around the summit of almost all the mountains above 3000 m in altitude and always characterized by the hispid stems.

The name *A. coelurai* Diels, to which Masamune applied the present species, can be found neither in Diels'[4] nor in Nannfeldt's works[5][6] on the Chinese *Adenophora*. It must be a miss-spelling for *A. coelestis* Diels. This plant, according to the original description, is recognized by sparsely pilose or glabrous simple stems 20～45 cm tall and 3～4 mm long discs. A specimen of *A. ceolestis*, Forrest 6200 (SHIN), is also different from the Taiwan plants in having discs more than 4 mm long and nearly glabrous stems.

2) **A. morrisonensis** Hayata, Mater. Fl. Formos. 165 (1911) & Ic. Pl. Formos. **2**: 115, pl. 10 (1912); Masam., Short Fl. Formos. 211 (1936) —— '*A. polymorpha* var. *coronopifolia* Trautv.': Hayata, Fl. Mont. Formos. 148 (1908).

Specim. exam. Dangai, Taroko, S. Suzuki 8707 (TAI); Mt. Tompo, 6500 ped., S. Sasaki s. n. (TAIF); Hattsukan to Tompo, H. Simada 920 (TAI); Hattsukan, S. Sasaki s. n. (TAI); Mt. Niitaka-zenzan, Chuang & Kao s. n. (TAI); Mt. Niitaka 9000 ped., T. Kawakami & U. Mori 1942 (TAIF, TI),—— syntype, 1943 (TAIF, TI), 2290 (TI) —— syntype; ibid., Tataka 9000 ped., R. Kanehira & S. Sasaki s. n. (TAIF); Ganzan (Niitaka) 9141 ped., S. Nagasawa 733 —— (TI) syntype & (KYO) isosyntype; Mt. Arisan, T. Takasu s. n. (TAI).

Distr. The subalpine region of Taiwan, endemic.

The present species is characterized by racemose inflorescences and nearly glabrous elongated stems. The leaves are usually linear-lanceolate, 7～15 cm long and 2～10 mm broad. Geographically *A. morrisonensis* is restricted to the subalpine region 2400-3000 m in altitude in the vicinity of Mt. Yushan (Morrison), and ecologically most frequent at the edge of the thickets or the forests. It is noteworthy that it can be also found in the limestone area of Pref. Hualien, the Pacific side of the island.

3) **A. triphylla** (Thunb). A. DC., Monogr. Camp. 365 (1830); DC., Prodr. **7**: 494 (1838); Fr. et Sav., Enum. Pl. Jap. **1**: 280 (1875); Kitam. in Acta Phytotax. Geobot. **5**: 208 (1936) & **10**: 308 (1941); Hara, Enum. Spermat. Jap. **2**: 91 (1952) ——*Campanula triphylla* Thunb., Fl. Jap. 87 (1784) —— *C. tetraphylla* Thunb., l. c. —— *A. tetraphylla* (Thunb.) Fisch. ex Ind. Kew. Pl. Phan. 40 (1895); Fedorov in Fl. URSS **24**: 361 (1957); Baranov in Quart. J. Taiwan Mus. **14**: 159 (1963) —— *A. verticillata* var. *triphylla* (Thunb.) Miq. in Ann. Mus. Bot. Lugd. Bat. 2: 192 (1866) —— '*A. verticillata* Fisch.': Henry, List Pl. Formos. 50, no. 572 (1896); Matsum. et Hayata, Enum. Pl. Formos. 217 (1906), p. p.;

Hayata, Fl. Mont. Formos. 148 (1908), quoad specim.; Masam., Short Formos. 211 (1936) —— '*A. verticillata* var. *angustifolia* Regel': Yamam. in J. Trop. Agr. Soc. Formos. **8**: 147 (1936) —— *A. verticillata* var. *linearis* Hayata, l. c. —— *A. triphylla* f. *linearis* (Hayata) Kitam., l. c. (1941), ut *linearia*; Hara, l. c. —— *A. triphylla* f. *hirsuta* Kitam., l. c. (1941); Hara, l. c.

Specim. exam. Mt. Kannonzan, Y. Simada s. n. (TAIF); Kameyama, T. Suzuki 16428 (TAI); Mt. Taiheizan, S. Sasaki s. n. (TAI); Pianan-ambu, S. Suzuki 5092 (TAI); Pianan to Mt. Nankotaizan, Masam. et al. 2960 (TAI); Mt. Taiheizan to Pianan-ambu, R. Kanehira s. n. (TAIF); Piánansha, S. Sasaki s. n. (TAIF); Mt. Nankotaizan 9000～10000 ped., S. Sasaki s. n. (TAIF); Mt. Hakkutaizan, U. Mori s. n. (TAIF); Musha-sa 7500 ped., T. Kawakami & U. Mori 1131 (TI; isotype in TAIF) —— type of var. *linearis*; Tonbara, S. Suzuki s. n. (TAI); Mt. Jurisekizan, U, Mori 2527 (TAIF); Musha to Onoue, S. Sasaki s. n. (TAI); Musha to Miharashi, G. Masam. et al. 2070 (TAI); Kotobuki to Tokiwa, Yamamoto & K. Mori 308 (TAI); Arisan, B. Hayata & S. Sasaki s. n. (TAIF); Akochobanchi, T. Ito s. n. (TAIF); Pasikau, Y. Kobayashi 1551 (TAIF); Ader to Taiwan, J. Ohwi 1638 (KYO) —— type of f. *hirsuta*.

Distr. Kyushu, Taiwan and Indo-China.

This species is characterized by verticillate leaves and small tubular flowers with exserted styles. The stems are more or less pubescent with patent unicellular hairs. The leaf-shape varies from linear to oblong or ovate. The plants with broad leaves grow together with those having linear leaves side by side, and sometimes the leaves on the upper part of the stems are linear while the lower leaves broad.

The present species is frequently found on the open grasslands below 2500 m in altitude throughout the island.

Literature

1) A. I. Baranov (1963) Quart. Jour. Taiwan Mus. **14**: 143 2) T. Sugiura (1942) Cytologia **12**: 422 3) H. Hara (1937) Jour. Jap. Bot. **13**: 464～468 4) F, L. E. Diels (1912) Notes Bot. Gard. Edinb. **5**: 173～177 5) J. A. Nannfeldt (1921) Acta Hort. Gothoburg. **5**: 13～23. 6) —— (1936) in Handel-Mazzetti Symb. Sin. **7**: 1068～1075.

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日本や台湾のツリガネニンジン属植物をどのように扱うべきかは，多くの議論のある

ところであるが，台湾のものについては，結局，タイザンイワギキョウ *A. uehatae*, ニイタカシャジン *A. morrisonensis*, サイヨウシャジン *A. triphylla* の3種を認めることにした。サイヨウシャジンは，葉が輪生すること，花盤が円筒状であること，花冠が小さいことなどによって，前者との区別は明瞭であるが，タイザンイワギキョウとニイタカシャジンの間には区別困難なものがしばしば現れる。タイザンイワギキョウの最も普通な形は，草丈は低く，葉は卵形で，花は茎頂に1，2個つけるものであり，ニイタカシャジンの普通な形は，丈は伸長し，葉は細長く，花序ものびて多数の花をつけるものである。花部の形態には，これといったちがいはみつからない。このような草丈や花序の大きさは，前者が3000 m 以上の高山の風衝地，後者が3000 m 以下の叢林の周辺部を主たる生育地とすることと関係がある。つまり，このような本来の niche を逸脱して生育する個体では上記の一般的な姿が失われて，両者は接近し区別がつきにくくなるというわけである。そこで，両者の重要な相異点として茎の毛の有無を考えてみた。茎の毛が本属全般にわたってどのような意味をもつかは検討する必要があるが，今，茎に逆向きの硬毛をもつ群をタイザンイワギキョウ，無毛であるかわずかに開出する散毛をもつ群をニイタカシャジンとして区別すると，前者は雪山山系および南湖大山から卑南主山に至る中央山脈の高山全域に分布するが，後者は玉山および阿里山周辺に限定され，先の垂直分布域の相異とともに，水平分布域の相異が明瞭にでてくる。この意味において，太魯閣附近の石灰岩壁からのニイタカシャジンの記録は特筆すべきものと思われる。タイザンイワギキョウは，日本のミヤマシャジンやヒマラヤの *A. coelestis* に類縁が求められたが，この形質を使うことによって，明確に区別できると思う。

本属植物の染色体数については，杉浦 (1942) が，$n=17$ および $n=51$ を報告しているが，台湾産のサイヨウシャジンとタイザンイワギキョウでは，ともに，$2n=34$ を数えることができた。

○高等植物分布資料 (42) Materials for the distribution of vascular plants in Japan (42)

○ホロムイソウ *Scheuchzeria palustris* L. この周極分布種は冷涼なミズゴケ湿原に生えるので，本州での産地は少く，従来関東北部以北に報告されていた。最近に井波一雄氏が岐阜県大野郡と吉城郡との境界，天生(アモウ)峠に見出された (36° 15′ N, 136° 58′ E)。これは信州を飛ばしての産地で，日本に於ける西南限地であり，同時に var. *americana* を度外視すれば，世界での南限と言えるかもしれない Hultén, The Circumpolar Plants 1: map 149, 1964 を参照)。しかし信州での産地を知ったので報告して置きたい。北安曇(アズミ)郡神城(カミシロ)村佐野の通称を親海(オヨミ)という小湿原がそれである。(36° 37′ N, 137° 50′ 48″ E) 海抜 740 m で天生峠よりずっと低いが，姫川源流地点の一つで清冷な小流を廻らし，他にも数種の北方系植物を産する。

(水島正美)